Name: ______________________________ Date: ________________

Polynomial Operations SOLUTION (version 152)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -9x^5 - 4x^3 - x^2 - 2x + 7$$

$$q(x) = 7x^5 - 2x^4 + x^2 + 8x + 3$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-9)x^5 + (0)x^4 + (-4)x^3 + (-1)x^2 + (-2)x^1 + (7)x^0 \\ q(x) &= (7)x^5 + (-2)x^4 + (0)x^3 + (1)x^2 + (8)x^1 + (3)x^0 \\ q(x) - p(x) &= (16)x^5 + (-2)x^4 + (4)x^3 + (2)x^2 + (10)x^1 + (-4)x^0 \\ q(x) - p(x) &= 16x^5 - 2x^4 + 4x^3 + 2x^2 + 10x - 4 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -3x^2 - 2x + 4$$

$$b(x) = -3x + 8$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-3x^2$	$-2x$	4
$-3x$	$9x^3$	$6x^2$	$-12x$
8	$-24x^2$	$-16x$	32

$$a(x) \cdot b(x) = 9x^3 + 6x^2 - 24x^2 - 12x - 16x + 32$$

Combine like terms.

$$a(x) \cdot b(x) = 9x^3 - 18x^2 - 28x + 32$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 152)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 15x^2 + 19x - 29 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 15 & 19 & -29 \\ -5 & & -10 & -25 & 30 \\ \hline & 2 & 5 & -6 & 1 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + 5x - 6 + \frac{1}{x+5}$$

In other words, $h(x) = 2x^2 + 5x - 6$ and the remainder is $R = 1$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 15x^2 + 19x - 29$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (2) \cdot (-5)^3 \ + \ (15) \cdot (-5)^2 \ + \ (19) \cdot (-5) \ + \ (-29) \\ &= (2) \cdot (-125) \ + \ (15) \cdot (25) \ + \ (19) \cdot (-5) \ + \ (-29) \\ &= (-250) \ + \ (375) \ + \ (-95) \ + \ (-29) \\ &= 1 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x + 5$. Thus, $f(-5) = 1$.